

FIGURE 2

RECEPTOR LOCATIONS - SOLVAY MINERALS MODELING ANALYSIS

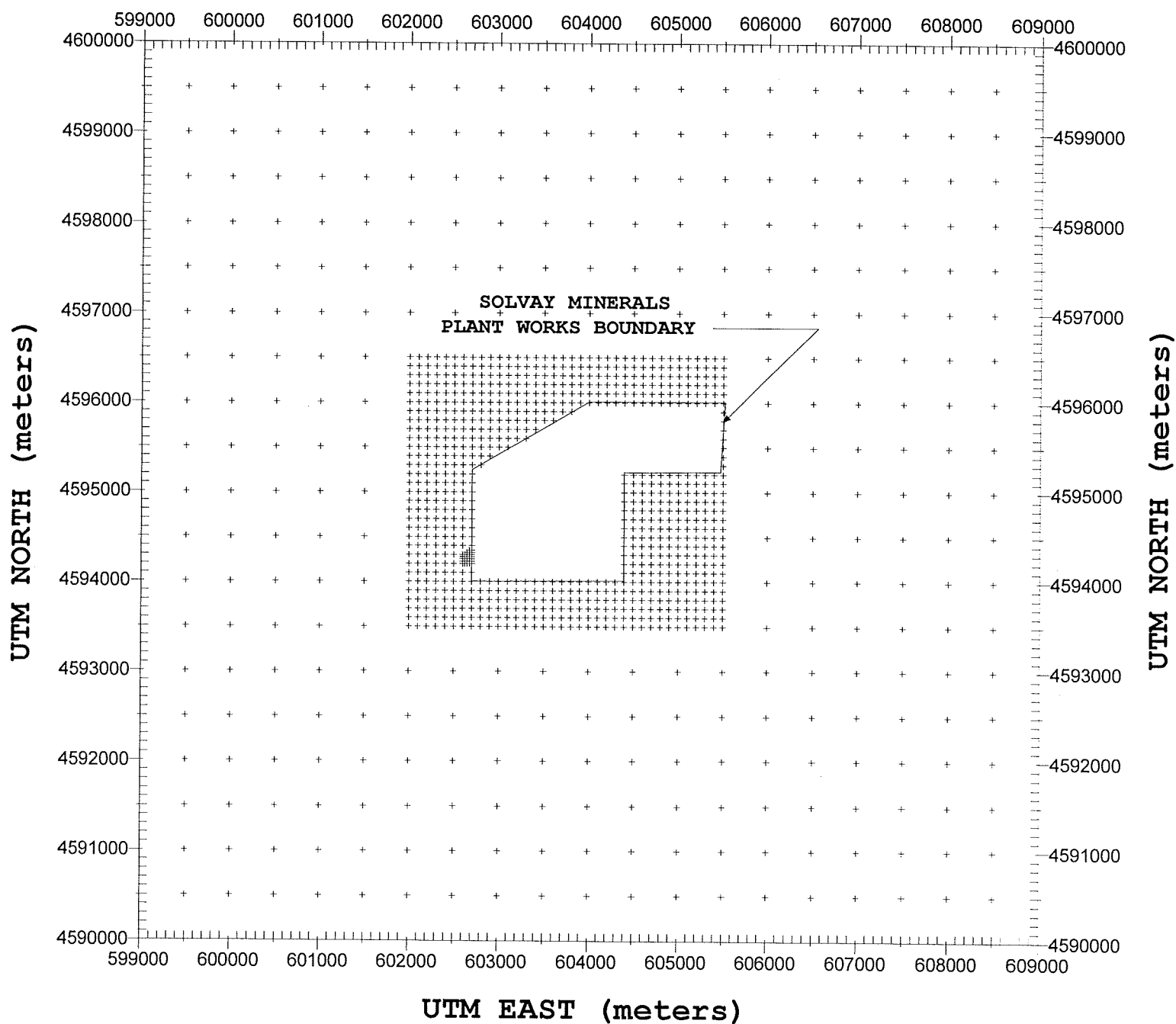
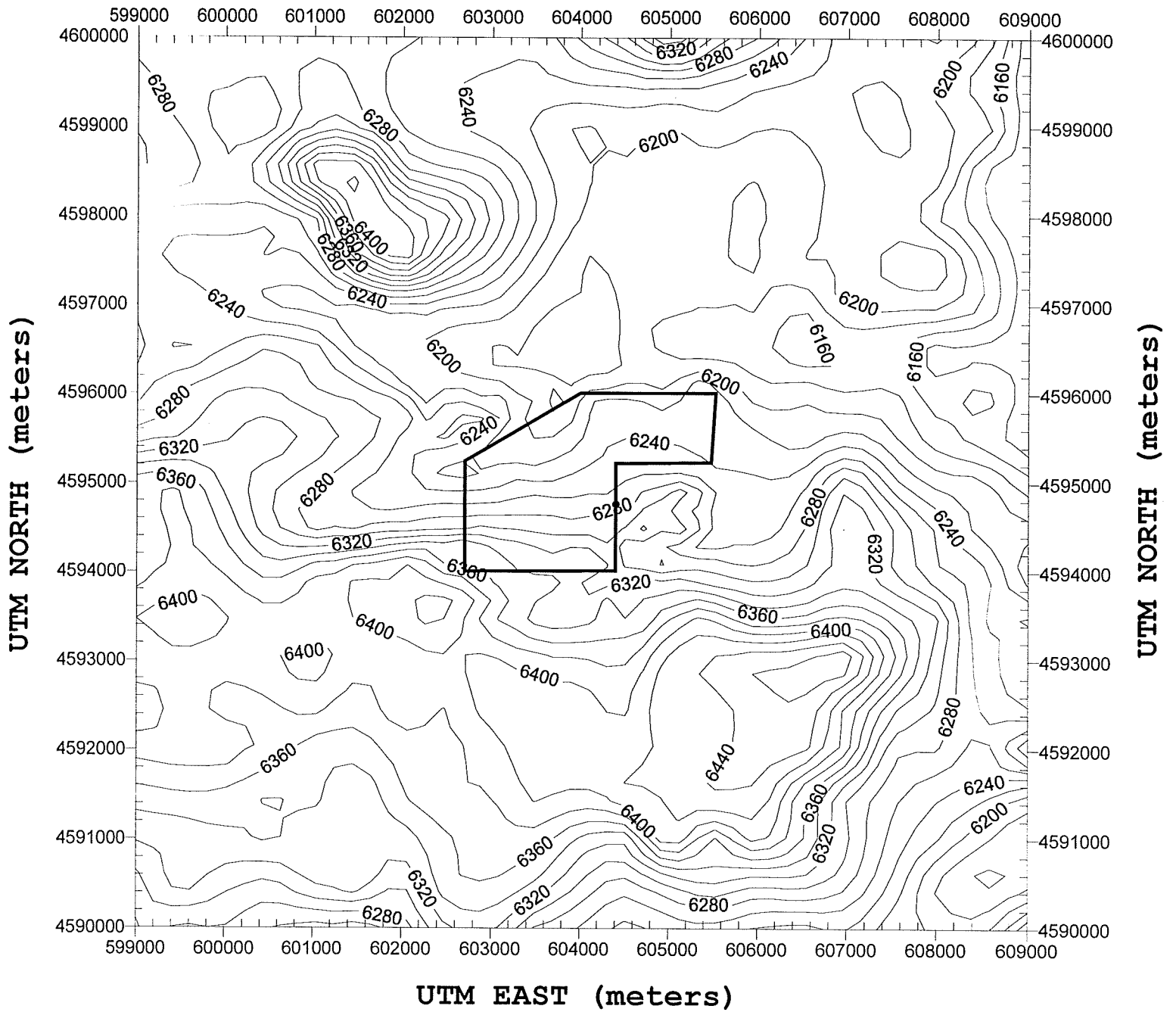


FIGURE 2a

ELEVATION CONTOURS OF TOPOGRAPHY NEAR SOLVAY MINERALS



Elevations Measured in Feet

Contour Interval = 20 Feet

Figure 2b. Topography Represented in Modeling Analysis for Solvay Soda Ash

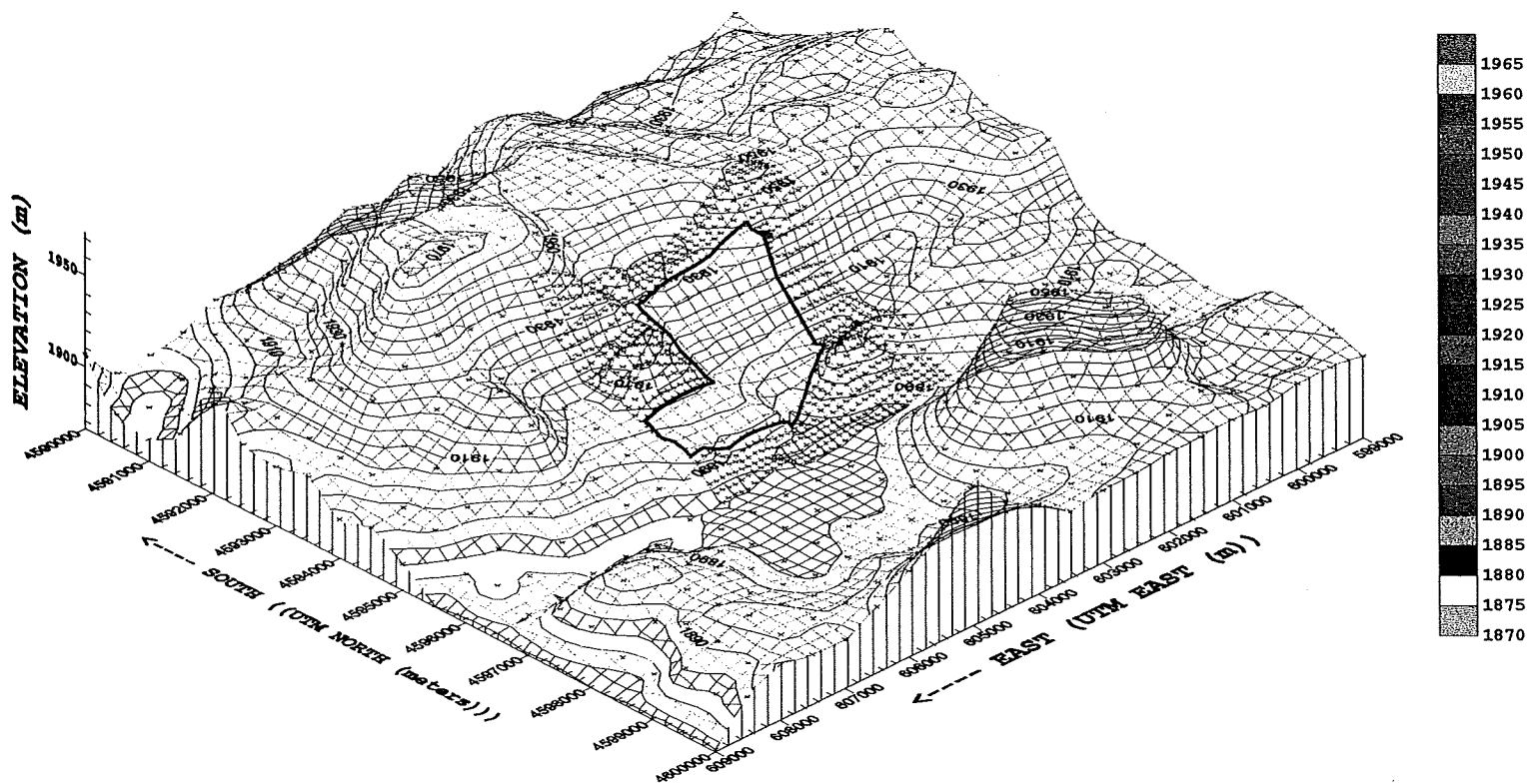


FIGURE 3

ANNUAL NO_x CONCENTRATIONS (ug/m³)

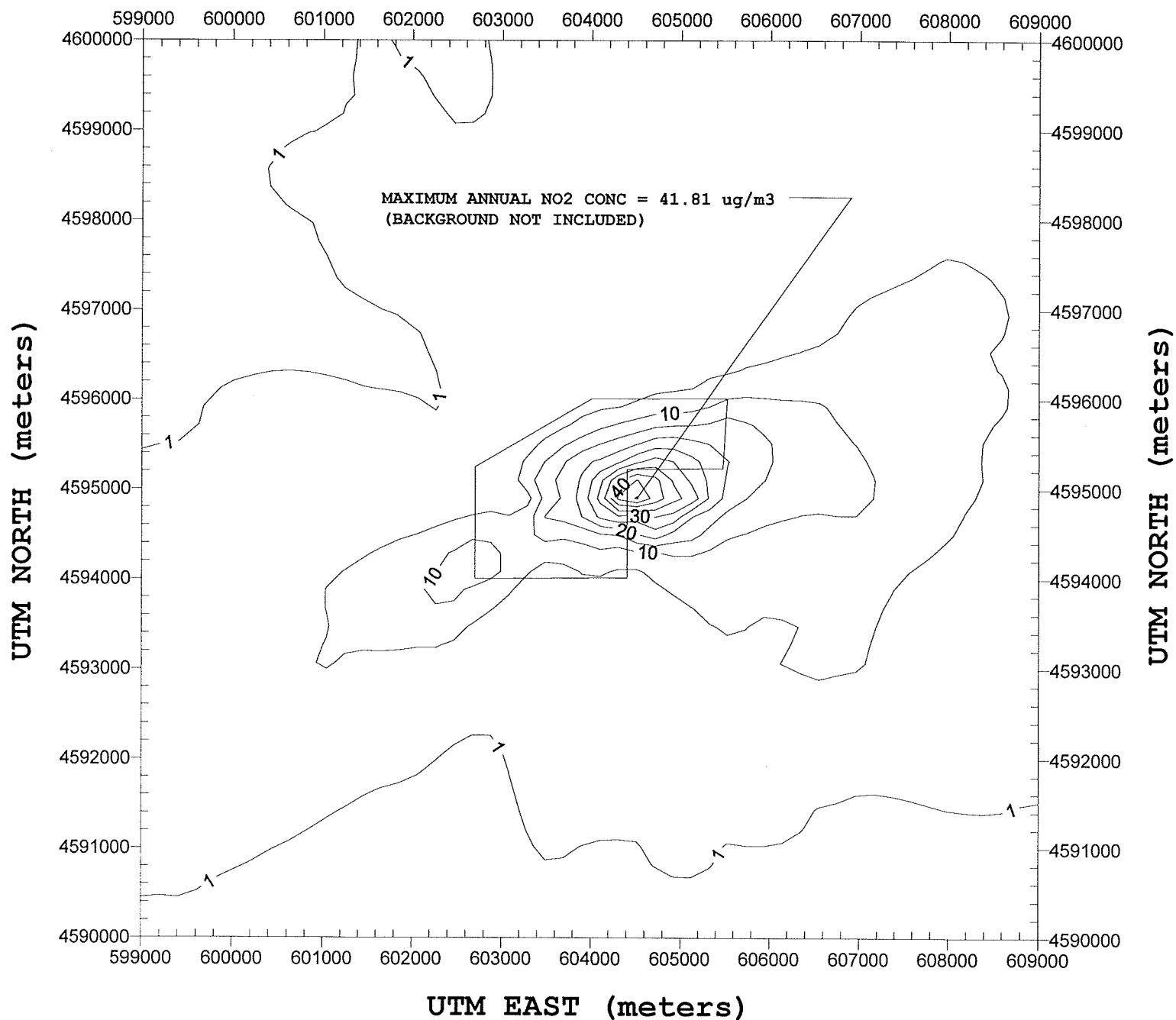


Table 3. Modeling Results for NAAQS Analysis using Ambient Ratio Method

Modeled Year	UTM Receptor Location		Maximum Annual NO ₂ Conc. (µg/m ³)	Background Annual NO ₂ Conc. (µg/m ³)	Total Annual NO ₂ Conc. (µg/m ³)	Annual NO ₂ NAAQS (µg/m ³)	Percent of Standard
	X (m)	Y (m)					
1988	604400	4594900	41.81	3.0	44.81	100	44.8%

♦ Carbon Monoxide (CO) ♦

The applicant modeled CO emissions from the existing and proposed new sources at the Solvay facility to determine compliance with the 1-hour and 8-hour NAAQS of 40,000 µg/m³ and 10,000 µg/m³, respectively. The modeled impact from all sources based on the highest second highest (HSH) 1-hour and 8-hour concentrations of CO were 4,133 µg/m³ and 1,148 µg/m³, respectively, and occurred during the 1988 meteorological data year. The background values for CO provide a conservative estimate based on the conclusion that Solvay's contribution is already included in the background values. The 1-hour and 8-hour model predicted impacts including background concentrations were 7,633 µg/m³ and 2,648 µg/m³, respectively, which are well below the applicable NAAQS. Based on the results of this analysis, the Division is satisfied that the NAAQS for CO will be protected.

♦ Particulate Matter under 10 Microns (PM₁₀) ♦

The applicant modeled PM₁₀ emissions from all sources at Solvay to determine compliance with the 24-hour and annual PM₁₀ NAAQS of 150 µg/m³ and 50 µg/m³, respectively. The highest second highest (HSH) modeled 24-hour PM₁₀ concentration was 28.81 µg/m³. Solvay choose to use the maximum monitored 24-hour PM₁₀ value of 57.0 µg/m³ rather than the second highest monitored value of 34.0 µg/m³ to conservatively estimate the impacts from regional PM₁₀ sources. Therefore, the HSH 24-hour modeled PM₁₀ impact including the background value was 85.81 µg/m³. The maximum modeled annual PM₁₀ concentration was 8.94 µg/m³; the predicted concentration including an 11.25 µg/m³ background value was 20.19 µg/m³. The modeled values show compliance with the applicable NAAQS for PM₁₀; results of the NAAQS modeling for PM₁₀ are presented in Table 4 and Table 5. Isopleth plots of the 24-hour and annual PM₁₀ impacts are presented in Figure 4 and Figure 5, respectively.

Table 4. Highest Second High 24-Hour PM₁₀ Modeling Results for NAAQS Analysis

Modeled Year	Receptor Location		2nd High 24-Hour PM ₁₀ Conc. (µg/m ³)	Background 24-Hour PM ₁₀ Conc. (µg/m ³)	Total 24-Hour PM ₁₀ Conc. (µg/m ³)	24-Hour PM ₁₀ NAAQS (µg/m ³)	Percent of Standard
	X (m)	Y (m)					
1989	602700	4594250	28.81	57.0	85.81	150	57.2%

Table 5. Annual PM₁₀ Modeling Results for NAAQS Analysis

Modeled Year	Receptor Location		Maximum Annual PM ₁₀ Conc. (µg/m ³)	Background Annual PM ₁₀ Conc. (µg/m ³)	Total Annual PM ₁₀ Conc. (µg/m ³)	Annual PM ₁₀ NAAQS (µg/m ³)	Percent of Standard
	X (m)	Y (m)					
1988	604400	4594900	8.94	11.25	20.19	50	40.4%

FIGURE 4

HIGHEST SECOND HIGH 24-HR PM10 CONC (ug/m3)

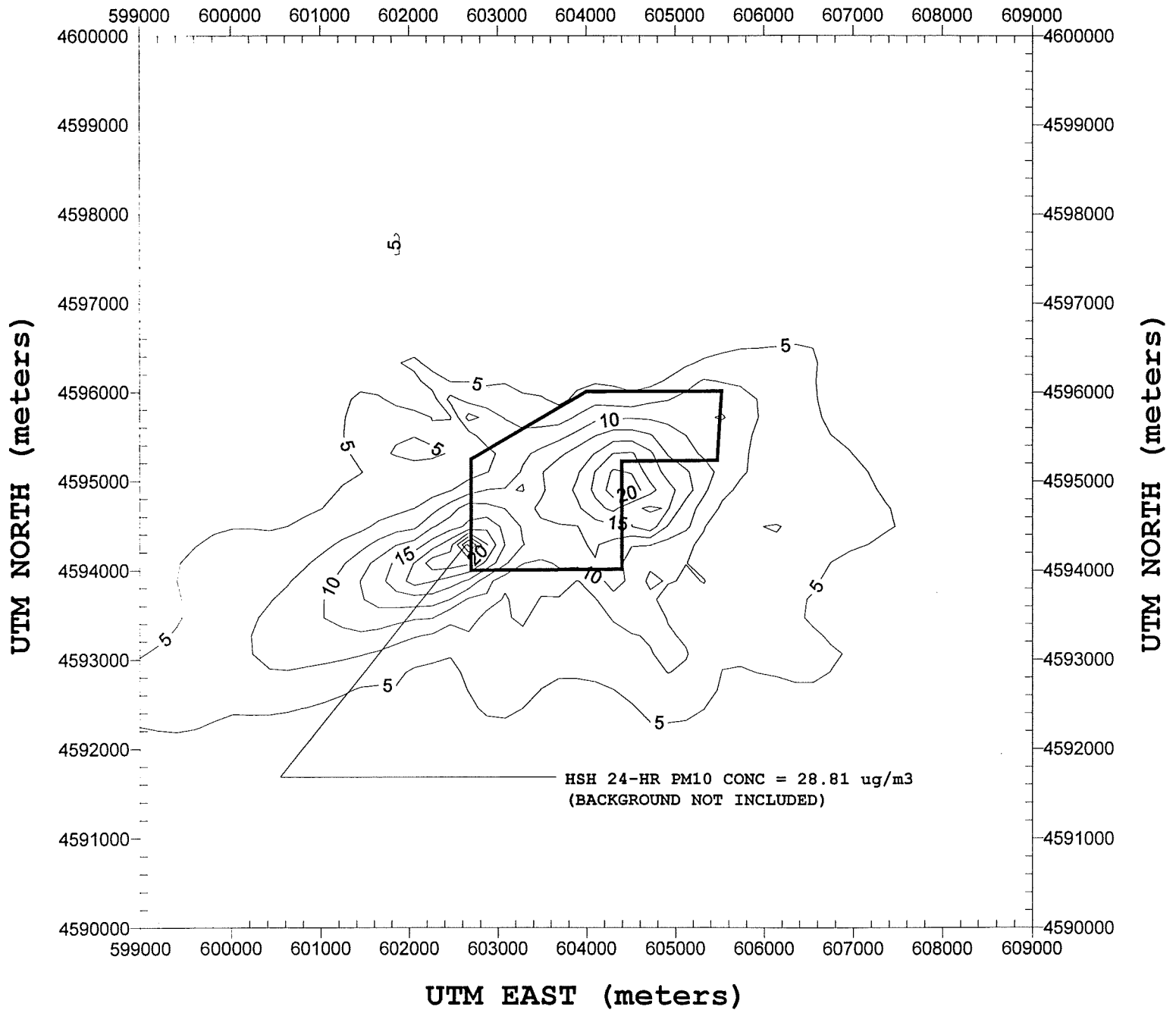
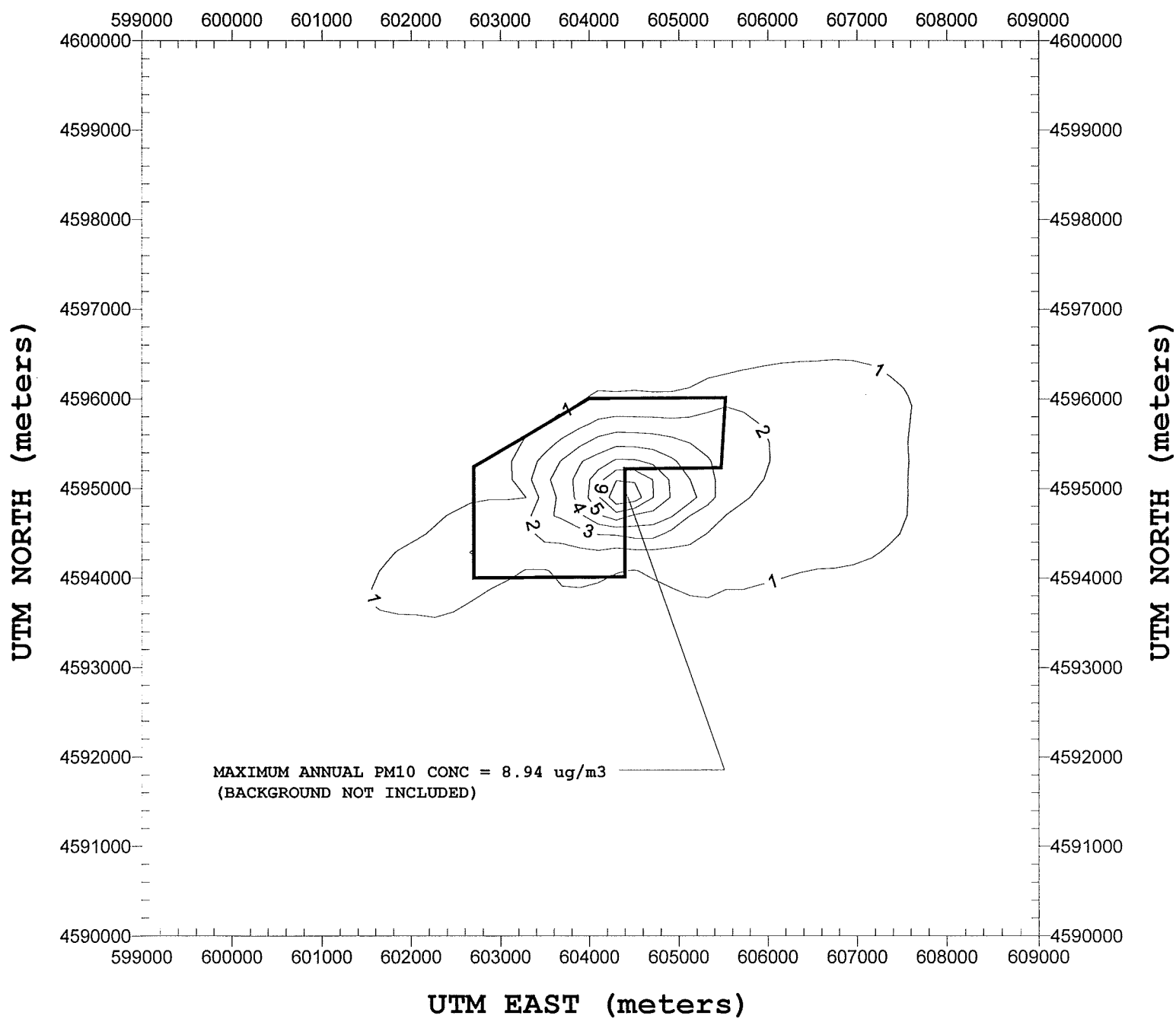


FIGURE 5

MAXIMUM ANNUAL PM10 CONC (ug/m3)



The 1996 PM₁₀ monitoring data from the four downwind trona production facilities reveals that the ambient air quality in this region was in compliance with all applicable PM₁₀ ambient standards during the calendar year of 1996. Based on the compliance monitoring in this region and the results of this analysis, the Division is satisfied that the proposed increase in allowable PM₁₀ emissions, and the existing PM₁₀ sources at Solvay Minerals facility will not contribute to any significant impacts at the other trona production facilities.

◆ Sulfur Dioxide (SO₂) ◆

The applicant modeled SO₂ emissions from this facility to determine compliance with the 3-hour, 24-hour and annual Wyoming Ambient Air Quality Standards of 1300, 260, and 60 µg/m³, respectively. The HSH modeled 3-hour and 24-hour ambient SO₂ concentrations were 446.21 µg/m³ and 79.00 µg/m³, respectively; the maximum modeled annual SO₂ concentration was 15.11 µg/m³. The results of this analysis indicate that model predicted concentrations of SO₂ from this facility are well below the applicable NAAQS. Based on the results of this analysis, the Division is satisfied that the NAAQS for SO₂ will be protected.

Hazardous Air Pollutants (HAPs) Analysis: The applicant submitted a modeling analysis for HAPs based on average tested HAP emission rates from the three existing Calciners. Testing was conducted during November 1996, using a gas chromatograph/mass spectrometer to provide an accurate identification of the speciated VOCs; the test results are provided in the permit application in Tables 3-2, 3-3, 3-4 and 3-5. The average tested emission rate for each HAP is shown along with a corresponding maximum emission rate which was derived to include three standard deviations. The A and B Calciners (AQD #17) were tested at the combined production rate of 400 tons per hour (TPH) and Calciner C (AQD #48) was tested at 200 TPH. The HAP emission rates for the proposed "D" Calciner (AQD #80) were estimated based on the tested emission rates of the existing Calciners at their respective production rates, and the average of the ratioed values was used to reflect the proposed 275 TPH production rate of the "D" Calciner.

EPA Reference Methods 18 and 25A were used for determining VOC emission rates, and EPA Reference Methods 0010, 0011, and 0030 were used for determining HAP emission rates. EPA Reference Methods 0010, 0011, and 0030 are reference methods that were developed for analyzing volatile and semi-volatile organic compounds and are recognized by the Division as acceptable methods for analyzing HAPs in conjunction with EPA Reference Methods 18 and 25A.

An ambient air impact was completed for each of the twenty-seven (27) HAPs listed in Table II. The applicant's modeling analysis was completed using HAP emission rates based test data for the existing calciners, projected emission rates from the new calciner and the mine vent exhaust. EPA's ISCST3 model was used to assess short-term concentrations of each of the HAPs; the models were run using a 500-meter coarse receptor grid centered over the facility in a 21x21 matrix. The modeled concentrations predicted by this analysis are shown in Table III. The modeled HAP concentrations were compared to the lowest and highest listed Acceptable Ambient Level (AAL) for twenty-two (22) HAPs found in EPA's National Air Toxics Clearinghouse (NATICH) data base; this data base lists AALs for 1-hour, 8-hour, 24-hour, and annual averaging periods for various states in the United States. The HAPs which exceeded the minimum AALs on an annual basis were 1,3 butadiene, benzene, formaldehyde and acrylonitrile; modeled concentrations of 1,3 butadiene were also found to exceed the minimum AAL for the 1-hour and 24-hour averaging periods, and modeled concentrations of benzene and formaldehyde were also found to exceed the minimum AAL over a 24-hour averaging

Table III. Modeling Results for Solvay Soda Ash HAP Analysis

(1987 - 1991 Rock Springs Meteorological Data)

	5-Year Maximum Impacts ($\mu\text{gm}/\text{m}^3$)			
	1-hour	8-hour	24-hour	Annual
ACETALDEHYDE	0.48	0.15	0.077	0.0071
ACETONE	0.33	0.1019	0.057	0.0050
ACETOPHENONE	0.032	0.010	0.0052	0.00048
ACROLEIN	1.23	0.37	0.20	0.018
*ACRYLONITRILE	1.52	0.46	0.26	0.023
BENZENE	25.29	7.72	3.97	0.37
BIPHENYL	0.046	0.014	0.0073	0.00068
BIS(2-ETHYLHEXYL)PHTHALATE	0.0030	0.00092	0.0005	0.00004
1,3 BUTADIENE	18.55	5.66	2.88	0.27
2-BUTANONE	4.74	1.45	0.82	0.072
2-CHLOROACETOPHENONE	0.0030	0.00092	0.0005	0.00004
CUMENE	0.004	0.0011	0.0006	0.00005
DI-N-BUTYLPHTHALATE	0.023	0.0071	0.0037	0.00034
DIBENZOFURAN	0.039	0.012	0.0062	0.00058
ETHYL BENZENE	2.51	0.76	0.42	0.038
FORMALDEHYDE	0.34	0.11	0.059	0.0050
HEXANE	7.85	2.40	1.24	0.116
*METHYLENE CHLORIDE	1.10	0.33	0.16	0.016
3/4 METHYLPHENOL	0.019	0.0058	0.0031	0.00028
N,N-DIMETHYLANILINE	0.016	0.0049	0.0026	0.00024
NAPHTHALENE	0.30	0.09	0.048	0.0044
PHENOL	0.18	0.056	0.029	0.0027
PROPIONALDEHYDE	0.14	0.042	0.022	0.0021
STYRENE	4.59	1.40	0.72	0.068
TOLUENE	10.47	3.19	1.69	0.156
*1,1,1-TRICHLOROETHANE	8.85	2.70	1.31	0.129
*TRICHLOROETHENE	9.11	2.84	1.57	0.135
XYLENE	13.87	4.23	2.25	0.207

Table III a. NATICH Lowest Allowable Ambient HAP Levels

	Lowest AALs (µg/m3)			
	1-hour	8-hour	24-hour	Annual
ACETALDEHYDE	90	900	4.89	0.45
ACETOPHENONE	150	-	40	49
ACROLEIN	2.3	2.3	0.6	0.0004
ACRYLONITRILE	21	21.5	1.18	0.0147
BENZENE	30	30	1.74	0.1
BIPHENYL	2.3	13	0.34	0.01
BIS(2-ETHYLHEXYL)PHTHALATE	50	50	4	0.2
1,3 BUTADIENE	7.2	220	1.2	0.003
2-BUTANONE	3900	5900	32.1	32.1
CUMENE	500	2450	588	0.009
ETHYL BENZENE	2000	4340	118	118
FORMALDEHYDE	15	4.5	0.033	0.004
HEXANE	1760	1800	432	176
METHYLENE CHLORIDE	260	870	9.45	0.2
NAPHTHALENE	440	500	120	14
PHENOL	154	95	45.6	10
PROPIONALDEHYDE	21	4290	-	-
STYRENE	215	1070	116	1.75
TOLUENE	1880	1870	10.2	10.2
1,1,1-TRICHLOROETHANE	10800	4550	1040	1000
TRICHLOROETHENE	1100	1350	36.5	0.42
XYLENE	2079	2170	3500	434

Table III b. NATICH Highest Allowable Ambient HAP Levels

	Highest AALs (µg/m3)			
	1-hour	8-hour	24-hour	Annual
ACETALDEHYDE	2700	4290	18000	600
ACETOPHENONE	490	-	4910	100
ACROLEIN	*80	6.9	6	0.83
ACRYLONITRILE	43	107	43	15
BENZENE	630	714	320	100
BIPHENYL	2.3	36	126	5
BIS(2-ETHYLHEXYL)PHTHALATE	100	119	200	120
1,3 BUTADIENE	110	52400	528	11
2-BUTANONE	*89000	11800	59000	1970
CUMENE	500	5860	24600	245
ETHYL BENZENE	*54000	43500	7200	5430
FORMALDEHYDE	*150	71	12	7.69
HEXANE	5300	36000	29000	200
METHYLENE CHLORIDE	17400	8330	8750	8440
NAPHTHALENE	*7900	1190	50000	167
PHENOL	950	1900	456	456
PROPIONALDEHYDE	21	4290	-	-
STYRENE	*42500	5120	21300	716
TOLUENE	*56000	8930	37700	7500
1,1,1-TRICHLOROETHANE	*250000	190000	191000	38000
TRICHLOROETHENE	10700	6430	134000	6840
XYLENE	6510	4400	7200	434

* 15-minute average

period. There were no occurrences where the maximum modeled concentration of any HAP was greater than the maximum AAL's for any averaging period.

A risk assessment was conducted for the HAPs which are suspected carcinogens. These HAPs include Acrylonitrile, Benzene, 1,3 Butadiene, Formaldehyde, Methylene Chloride, Trichloroethene, and Bis(2-Ethylhexyl)phthalate. A unit risk factor was obtained from the IRIS data base for each of the HAP's listed above. Calculated risk was determined by multiplying the maximum modeled annual concentration by the appropriate unit risk factor, and multiplying this value by one million to determine the risk of contracting cancer on the basis of 1 in a million. Results of the risk assessment are shown in Table IV.

The risk assessment indicated that 1,3 Butadiene and Benzene are the only HAPs which have a calculated risk of exposure to be greater than 1 in a million; the calculated risk for 1,3 Butadiene was 7.6E-05, or approximately 76 in a million. Summing the risk for all carcinogens emitted from this facility yields a total risk of 79.1E-06, or approximately 79 in a million, which indicates that 1,3 Butadiene is the greatest contributor, based on the applicant's analysis of average tested HAP emission rates.

The Wyoming Air Quality Standards and Regulations do not contain ambient standards for HAP's. The regulations do require that HAP emissions be addressed through analysis of BACT. The review of VOC controls, HAP's being a subset of the VOC emissions, in the BACT section of this analysis has addressed this issue. The applicant's analysis demonstrates that the majority of the modeled concentrations from this facility are below the most stringent AAL's used for comparison and none of the modeled concentrations exceed any of the maximum AAL's from other states based on the average tested HAP emission rates.

PSD Significant Impact Analysis:

◆ Nitrogen Oxides (NO_x) ◆

The increase in allowable NO_x emissions due to this modification is 235 TPY. However, the proposed increase has been offset by the summation of all actual decreases in NO_x emissions since the last PSD permit for nitrogen oxides. Therefore, the net change in NO_x emissions from the proposed modification is below the PSD significant emission rate of 40 TPY, and a PSD analysis for NO₂ is not required.

◆ Particulate Matter (PM₁₀) ◆

The allowable PM₁₀ emissions from Solvay Minerals including the net emissions increase from the proposed modification is 384.8 TPY. The net increase in particulate emissions due to this modification is 31.33 TPY, and is above the PSD significant emission rate of 15 TPY for PM₁₀. Therefore, a significant impact analysis is required under PSD regulations to determine the PM₁₀ impacts from the proposed modification. These impacts are compared to PSD modeling significant impact levels (SIL's) for PM₁₀ to determine if further impact analyses for this pollutant are required. Results of this analysis are presented below:

<u>Source Group</u>	<u>Averaging Period</u>	<u>Modeled Conc.</u>	<u>PSD SIL's</u>
Proposed PM ₁₀ IC	Annual	1.43 µg/m ³	1.0 µg/m ³
Sources @ Solvay	HSR 24-hour	10.7 µg/m ³	5.0 µg/m ³

The applicant also modeled the entire 384.8 TPY of PM₁₀ to demonstrate that total PM₁₀ impacts from Solvay Minerals are localized and do not show a significant impact at the other trona production facilities in this region. The results of this analysis

Table IV. Results of Solvay Soda Ash Air Toxics Risk Assessment

HAP Pollutant	Unit Risk Factor	Maximum Modeled Annual Concentration ($\mu\text{g}/\text{m}^3$)	Calculated Risk
*Acrylonitrile	6.8×10^{-6}	0.023	1.56×10^{-7}
Benzene	8.3×10^{-6}	0.37	3.07×10^{-6}
Bis(2-Ethylhexyl)phthalate	2.4×10^{-7}	0.00004	9.6×10^{-12}
1,3 Butadiene	2.8×10^{-4}	0.27	7.56×10^{-5}
Formaldehyde	1.3×10^{-5}	0.005	6.5×10^{-8}
*Methylene Chloride	4.1×10^{-6}	0.016	6.56×10^{-8}
*Trichloroethene	1.3×10^{-6}	0.135	1.76×10^{-7}

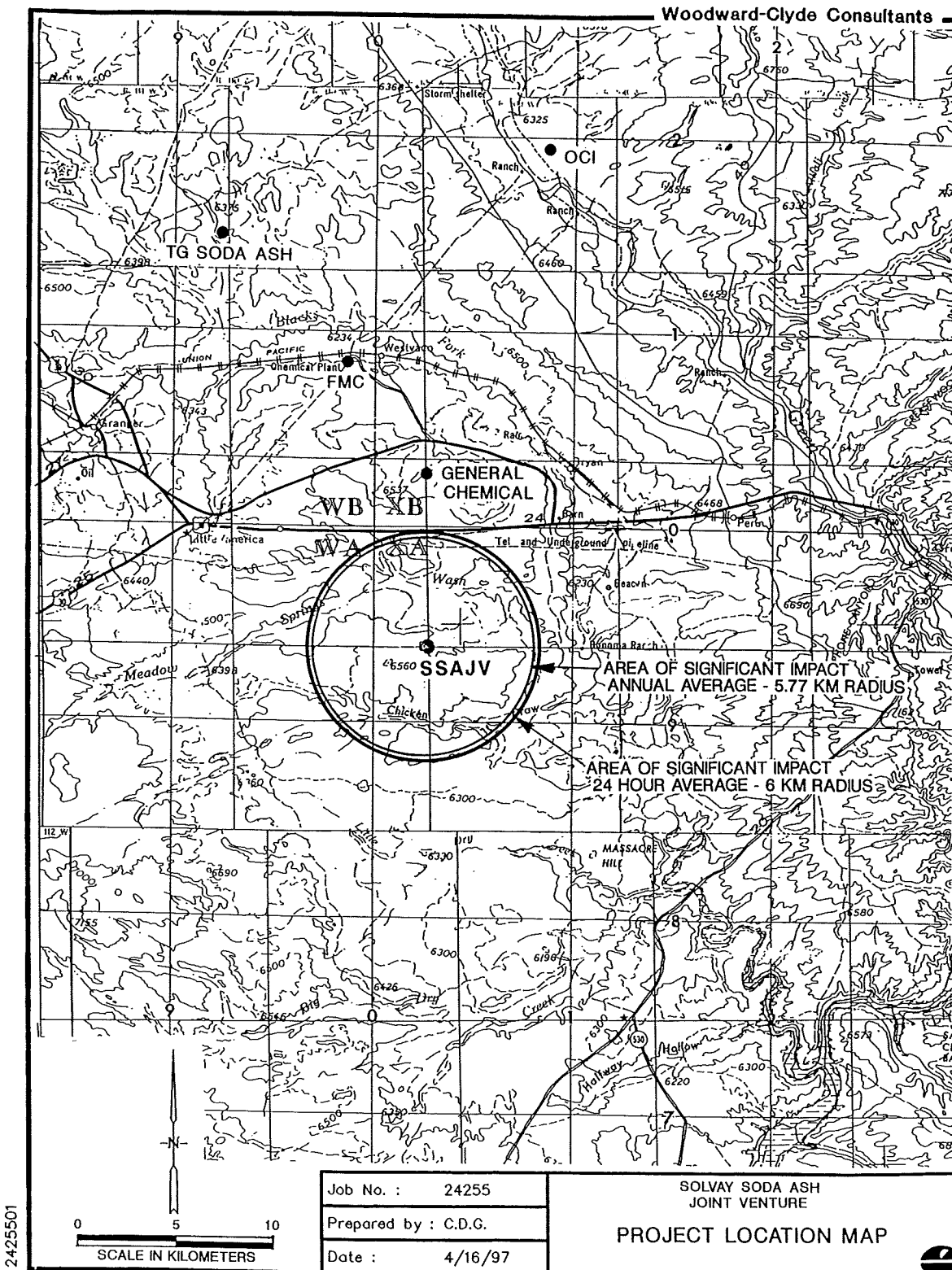


FIGURE 6. PM_{10} SIGNIFICANT IMPACT RADII - SOLVAY SODA ASH EXPANSION

show that the $1.0 \mu\text{g}/\text{m}^3$ and the $5.0 \mu\text{g}/\text{m}^3$ PM_{10} impacts from all existing and proposed sources occur within 2.0 kilometers of Solvay's plant works boundary. A plot which shows the PM_{10} significant impact radii for Solvay Minerals along with the location of the other trona production facilities is presented in Figure 6.

The Division modeled all PM_{10} sources at Solvay Minerals to assess PM_{10} impacts at General Chemical. A single discrete Cartesian receptor was located at the site of General Chemical's GR-3-X "E" boiler, which is located 10.2 kilometers (6.3 miles) northeast of Solvay Minerals; the UTM coordinate of the boiler is (616300,4605500). The maximum modeled annual PM_{10} concentration from Solvay Minerals at General Chemical was $0.15 \mu\text{g}/\text{m}^3$, and the highest-second high model predicted 24-hr concentration was $1.50 \mu\text{g}/\text{m}^3$. The results of this analysis indicate that PM_{10} impacts from the Solvay facility do not significantly impact the General Chemical facility, and will produce even less of an impact at any of the other more distant trona production facilities in this region.

The Division also modeled all PM_{10} sources at the General Chemical facility to assess PM_{10} impacts at the Solvay facility. The maximum model predicted annual PM_{10} concentration was $0.44 \mu\text{g}/\text{m}^3$, and the highest-second highest model predicted 24-hr concentration was $6.00 \mu\text{g}/\text{m}^3$ at UTM coordinate (604000,4594000), which is greater than the PM_{10} 24-hr significant impact level of $5.0 \mu\text{g}/\text{m}^3$. Based on the results of the significant impact analysis, the applicant choose to model all increment consuming sources at the two (2) nearest trona production facilities: General Chemical and FMC.

PSD Class II Increment Consumption:

◆ Particulate Matter (PM_{10}) ◆

All sources at Solvay Minerals that emit particulate matter consume increment, as this facility was constructed after the major source baseline date for PM_{10} . A Class II PM_{10} increment consumption analysis was completed which included the increment consuming sources at General Chemical and FMC, and all existing and proposed PM_{10} sources at Solvay Minerals. The purpose of this analysis was to determine compliance with the 24-hour and annual PM_{10} PSD increments of $30 \mu\text{g}/\text{m}^3$ and $17 \mu\text{g}/\text{m}^3$, respectively.

The HSH modeled 24-hour PM_{10} cumulative impact was $28.81 \mu\text{g}/\text{m}^3$, and the maximum annual cumulative PM_{10} impact was $8.94 \mu\text{g}/\text{m}^3$; these impacts are identical, in space and in time, to the predicted impacts referenced in the NAAQS analysis for PM_{10} . Therefore, the Class II increment analysis indicates that the amount of PM_{10} increment consumed by General Chemical and FMC at or near Solvay Minerals is negligible for both averaging periods, and that all of the PM_{10} increments considered in this analysis are consumed by the sources at Solvay Minerals. This coincidence is largely due to the fact that General Chemical and FMC are located 10.2 kilometers and 14.2 kilometers, respectively, downwind of Solvay Minerals. Additionally, the majority of the sources of PM_{10} at General Chemical and FMC were constructed before the major source baseline for PM_{10} , and these two facilities therefore have fewer PM_{10} sources that consume increment. The amount of PM_{10} increment consuming emissions attributable to General Chemical and FMC amount to 10.0 lb/hr and 1.7 lb/hr, which are dominated by the 88.4 lb/hr of allowable PM_{10} increment consuming emissions modeled for Solvay Minerals.